College Algebra
Section 3.4
Solving Exponential and Logarithmic Equations

1. Rewrite the original equation in a form that allows the use of the One-to-One Properties of exponential or logarithmic functions.
2. Rewrite an *exponential* equation in logarithmic form and apply the Inverse Property of logarithmic functions.
3. Rewrite a *logarithmic* equation in exponential form and apply the Inverse Property of exponential functions.

Solve for x

$5^x = 125$

$5^x = 5^3$

$x = 3$

or

$\log_5 5^x = \log_5 125$

$x = 3$

$7^x = \frac{1}{49}$

$7^x = 7^{-2}$

$x = -2$

$4^{2x-1} = 64$

$4^{2x-1} = 4^3$

$2x - 1 = 3$ (+1, +1)

$\frac{2x}{2} = \frac{4}{2}$

$x = 2$

$\log_4 x = 3$

$4^3 = x$

$64 = x$

Solve for x

$\ln e^{x^2}$ Inverse Property

x^2

$2^{\log_2 x^2}$

x^2

Solve

$$\frac{2e^x}{2} = \frac{10}{2}$$

$$e^x = 5$$

$$\ln e^x = \ln 5$$

$$x = 1.609$$

$$4(3^x) = 20$$

$$\frac{4(3^x)}{4} = \frac{20}{4}$$

$$3^x = 5$$

$$\log_3 3^x = \log_3 5$$

$$x = \log_3 5$$

Change of Base

$$x = \frac{\log_{10} 5}{\log_{10} 3}$$

$$x = 1.4650$$

Solve

$e^x - 9 = 19$

$+9 \quad +9$

$e^x = 28$

$\ln e^x = \ln 28$

$x = 3.3322$

$3^{2x} = 80$

$\log_3 3^{2x} = \log_3 80$

$2x = \log_3 80$ Change of Base

$2x = \frac{\log_{10} 80}{\log_{10} 3}$

$2x = 3.9887$

$\frac{2x}{2} = \frac{3.9887}{2}$

$x = 1.994$

$2^{3-x} = 565$

$\log_2 2^{3-x} = \log_2 565$

$3 - x = \log_2 565$

$3 - x = \frac{\log 565}{\log 2}$ Change of Base

$3 - x = 9.142$

$-3 \quad -3$

$-x = 6.142$

$\frac{-x}{-1} = \frac{6.142}{-1}$

$x = -6.142$

Solve

$500e^{-x} = 300$

$\frac{}{500} \qquad \frac{}{500}$

$e^{-x} = .6$

$\ln e^{-x} = \ln .6$

$-x = -.511$

$\frac{}{-1} \qquad \frac{}{-1}$

$x = .511$

$7 - 2e^{x} = 6$

$-7 \qquad -7$

$-2e^{x} = -1$

$\frac{}{-2} \qquad \frac{}{-2}$

$e^{x} = \frac{1}{2}$

$\ln e^{x} = \ln \frac{1}{2}$

$x = -.693$

Solve

$\ln x = -3$

$e^{\ln x} = e^{-3}$ Raise each side as a power of e

$x = .0498$

$x = .050$ Rounded to thousandths

$\log_{10} x = 6$

$10^{\log_{10} x} = 10^{6}$ Raise both sides as a power of 10

$x = 1,000,000$

$\ln \sqrt{x+2} = 1$

$\ln (x+2)^{\frac{1}{2}} = 1$

$\frac{1}{2} \ln (x+2) = 1$ Power Rule

$\frac{\frac{1}{2}}{\frac{1}{2}}$

$\ln (x+2) = 2$

$e^{\ln(x+2)} = e^{2}$

$x+2 = 7.389$

$-2 \quad -2$

$x = 5.389$

$\ln x + \ln (x-2) = 1$

$\ln x(x-2) = 1$ Product Rule

$\ln x^2 - 2x = 1$

$e^{\ln x^2 - 2x} = e^{1}$

$x^2 - 2x = 2.718$

$-2.718 \quad -2.718$ Quadratic Set = 0

$x^2 - 2x - 2.718 = 0$ Quadratic Formula

$a=1$ $b=-2$ $c=-2.718$

$x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(1)(-2.718)}}{2(1)}$

$x = \frac{2 \pm \sqrt{4 + 10.873}}{2}$

$x = \frac{2 \pm \sqrt{14.873}}{2}$

$x = \frac{2 \pm 3.857}{2}$

$x = \frac{2+3.857}{2}$ $\quad x = \frac{2-3.857}{2}$

$x = 2.928$ $\quad x = -.929$ Does not check

$x = 2.928$